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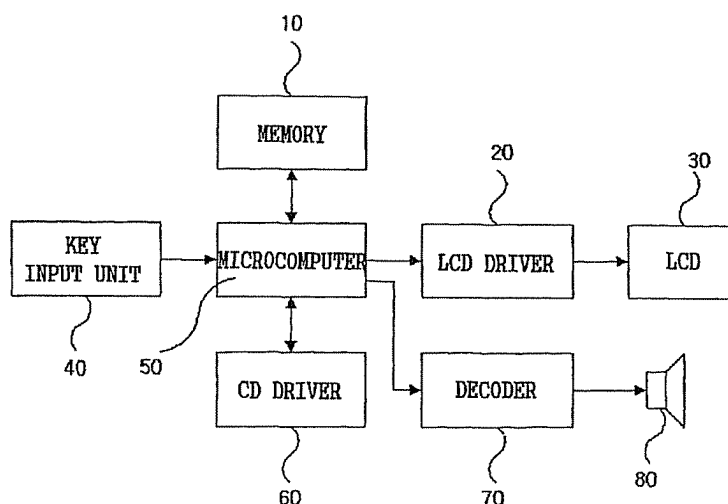
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(54) Title: PORTABLE CD PLAYER DISPLAYING CAPTION DATA AND AUDIO CD HAVING CAPTION INDEX DATA AND SYSTEM FOR PROVIDING CAPTION DATA



(57) Abstract: Disclosed is a portable CD player for reading out data from a CD separately recorded with an audio signal and caption data or index data, respectively, and outputting the read-out audio signal and caption data or index data in such a manner that they are synchronized with each other. An audio CD or data CD is also provided which is separately recorded with an audio signal or digital audio signal, and caption data or index data including or not including the caption data, respectively. During the playback, the audio CD or data CD exhibits a considerably reduced noise generation rate, as compared to conventional cases in which an audio signal and caption data are recorded in a mixed manner. The audio CD or data CD can be used, using a conventional driver. The user can obtain an improved learning effect, using the portable CD player. Since data can be received from a remote place, there is an advantage in that it is possible to achieve an easy data update



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PORTABLE CD PLAYER DISPLAYING CAPTION DATA AND  
AUDIO CD HAVING CAPTION INDEX DATA AND SYSTEM FOR  
PROVIDING CAPTION DATA

Technical Field

5           The present invention relates to a portable CD player capable of  
displaying a caption corresponding to the contents of an audio CD or the  
lyrics of a song recorded on the audio CD to provide a language learning  
effect or a language mastering effect expected by a repeated playback  
10       function thereof, or to provide a song lyrics learning effect, caption-displaying  
audio and data CDs recorded with caption data or index data including  
specific information, and a learning system using the portable CD player.

Background Art

          For learning of a language, various storage media such as cassette  
tapes, video tapes, CDs, DVDs, and memory cards, and various players  
15       adapted to play back the stored contents of such storage media, are used.  
Such storage media and players are adapted to improve the language listening  
comprehension. For example, for learning of a foreign language, the  
pronunciation of a native speaker is recorded on a storage medium, and  
played back by a player. Conventionally, cassette tapes and CDs have been  
20       mainly used as such storage media. However, they involve inconvenience in  
that it is necessary to use a separate teaching material written with a text  
corresponding to audio signals recorded on an associated storage medium, for  
example, a text corresponding to sentences or pronunciations being played  
back.

25           Such inconvenience may be eliminated to a certain degree, using  
video tapes or data CDs capable of displaying a caption. In this case,  
however, it is also necessary to use a separate teaching material written with a  
text of sentences or words needed for learning of a language. Furthermore,  
such video tapes or data CDs have a drawback in that they are expensive, as  
30       compared to cassette tapes and audio CDs only for playback of audio, thereby  
hindering their popularization.

          Another problem of such conventional learning assistance devices is

that it is difficult to update data. In other words, there is no method for allowing the user to obtain data to be newly learned, other than a method in which the user purchases a new learning storage medium containing updated data. As a result, illegal duplication of storage media becomes prevalent. For this reason, it is necessary to provide an inexpensive learning-assistant storage media and player capable of inexpensively and easily updating learning data, irrespective of time and place.

Meanwhile, audio CDs have been popularized as a substitute for LP discs traditionally used as playback media for music appreciation. Such audio CDs are convenient in that they are automatically played back, once in a state of being loaded in a CD player. In order to play back conventional LP discs, however, the user should press a play button after loading an LP disc on a turntable. Furthermore, during the playback of one track on the LP disc, if the user desires to play back another track on the LP disc, he should manually move the playback needle of the player to a desired track on the LP disc. Audio CDs do not involve such inconvenience encountered in conventional LP discs. Meanwhile, schemes for recording data on audio CDs have been advanced from a recording scheme capable of recording only audio signals to a recording scheme capable of recording data in accordance with a multi-session recording format. In accordance with the multi-session recording scheme, a multi-session type CD can be produced which is recorded with general data in addition to audio signals. In spite of such an advance, conventional audio CDs are mainly used to record audio data (including voice data) on their audio tracks.

The above mentioned CDs have various problems. First, where the user listens to music by playing back an audio CD, it is impossible to rapidly search for a desired track on the audio CD to select the track. In other words, when the user desires to hear a desired music piece, for example, a fifth music piece, from a plurality of music pieces recorded on an audio CD, using a conventional CD player (reproducing device), this can be achieved by repeatedly pressing an "FF (Fast Forward)" button equipped in the CD player five times in a play mode to select a track corresponding to the desired music piece. However, this manipulation is inconvenient, in particular where a desired music piece is selected from an audio CD recorded with several ten

music pieces or more. Furthermore, where it is desired to find a desired portion of the selected music piece, this can be achieved only by listening to the music piece until the music piece is played back from its start to its desired portion. This is also inconvenient.

5           In order to solve such inconvenience, a technique has been proposed which can provide a function for displaying a list of music pieces recorded on an audio CD, based on information about respective artist names and music titles relating to the music pieces, and selecting a desired one of the listed music pieces to rapidly play back the selected music piece. However, this  
10   function is only a simple music selecting function. Furthermore, it is necessary to provide a function of efficiently sorting and managing music pieces, in particular in the case of MP3 players adapted to play back digital audio format data files such as MP3 files. If such a function is not provided, an increase in search time or search error rate may occur, thereby degrading  
15   utility, taking into consideration the fact that audio CDs may be recorded with data of diverse genres such as children's stories, lectures, sermons, and lessons for learning languages such as English, Japanese, and German.

          Second, there is a disadvantage involved with the case in which the user desires to learn a song played back from a general audio CD while  
20   viewing the lyrics of the song. Conventionally, such song lyrics are provided in a state of being written on a separate paper sheet. Where such a paper sheet is lost due to the user's carelessness, inconvenience may occur because it is necessary to purchase a book printed with the song lyrics or to manually write the song lyrics on a separate paper sheet. Such a  
25   disadvantage is involved with the case in which audio signals are played back from a data CD recorded with digital audio format data files such as MP3 files. Thus, conventional CDs are mainly used only for the function of playing back music or voice.

          Third, in the case of audio CDs and data CDs such as MP3 CDs, it is  
30   impossible to rapidly perform a block repeat and release function for a desired portion of a music piece.

          Fourth, conventional audio CD players and MP3 CD players have no pronunciation correcting function such as a microphone mixing function.

          Accordingly, in association with audio signals or files mainly

including voice data, for example, digital audio format data files such as MP3 files, which are recorded in conventional CDs, it is required to provide a caption display technique for displaying a caption corresponding to the contents of a desired file, a mapping technique for accurately and rapidly searching for a desired portion of a desired audio file, a technique for sorting and searching the contents of music pieces in terms of artists, genres, or song titles, a microphone mixing technique for correction of pronunciation, and a technique for providing a powerful repeat function.

#### Disclosure of the Invention

The present invention has been made in view of the above mentioned problems, and an object of the invention is to provide a portable CD player capable of displaying a caption corresponding to the contents of an audio or data CD to provide a learning effect such as a language learning effect, and displaying the lyrics of a song while playing the song in a Karaoke mode so that it is usable for amusement.

Another object of the invention is to provide a caption-displaying audio or data CD recorded with an audio signal and caption data or index data including the caption data, the audio or data CD being capable of simultaneously providing the audio signal and the caption data or index data synchronized with the audio signal, allowing an easy search for desired contents of the audio signal, and a rapid and easy block repeat and release for the contents, avoiding generation of noise involved with a conventional recording system adapted to record an audio signal and caption data in a mixed manner on the same track when the audio signal and caption data are played back, and being used in a conventional driver.

Another object of the invention is to provide a portable CD player having a microphone mixing function for drill on pronunciation, and a separate microphone volume adjusting function.

In accordance with one aspect, the present invention provides a portable CD player comprising: a CD driver for reading out and outputting an audio signal and caption data or index data synchronized with the audio signal from an audio or data CD recorded with the audio signal and the caption data or index data; a microcomputer internally provided with a program for

executing a particular function in accordance with a command inputted from a key input unit, and a program for reading out the audio signal and the caption data or index data respectively outputted from the CD driver, and controlling the read-out audio signal and caption data or index data; a memory for storing the caption data or index data synchronized with the audio signal and sent from the microcomputer; a decoder for demodulating the audio signal sent from the microcomputer, and outputting the demodulated audio signal through a speaker; and an LCD driver for outputting the audio signal while simultaneously outputting particular information or a particular block on the basis of the caption data or index data synchronized with the audio signal, through an LCD, under a control of the microcomputer.

In accordance with another aspect, the present invention provides an audio CD recorded with an audio signal on a track thereof, wherein caption data and/or particular information synchronized with the audio signal is recorded on a predetermined portion of an audio track of the audio CD so that a caption is outputted through an LCD when the audio signal is played back.

In accordance with another aspect, the present invention provides a data CD recorded with data of a digital audio format, and caption data or index data synchronized with the audio signal on data sessions of multiple sessions, the index data including the caption data and/or particular information.

#### Brief Description of the Drawings

The above objects, and other features and advantages of the present invention will become more apparent after a reading of the following detailed description when taken in conjunction with the drawings, in which:

Fig. 1 is a block diagram illustrating an embodiment of a CD player according to the present invention;

Fig. 2 is a block diagram illustrating another embodiment of the CD player according to the present invention;

Fig. 3 is a block diagram illustrating another embodiment of the CD player according to the present invention;

Fig. 4 is a block diagram illustrating another embodiment of the CD player according to the present invention;

Fig. 5a is a schematic diagram illustrating the format of a conventional caption data file;

Fig. 5b is a schematic diagram illustrating the format of a caption data file according to the present invention;

5 Fig. 6 is a diagram illustrating a detailed structure of the index data file format shown in Fig. 5b;

Fig. 7 is a flow chart illustrating operations of the CD player shown in Fig. 1;

10 Fig. 8 is a schematic view illustrating an embodiment of a menu selection screen according to the present invention;

Fig. 9 is a schematic view illustrating another embodiment of the menu selection screen according to the present invention; and

15 Fig. 10 is a schematic diagram illustrating a network for providing a caption data file or index data file to the CD player according to the present invention via the Internet.

#### Best Mode for Carrying Out the Invention

Now, a portable CD player, an audio CD and a data CD according to the present invention will be described in detail with reference to the annexed drawings.

20 Fig. 1 is a block diagram illustrating an embodiment of the portable CD player according to the present invention.

As shown in Fig. 1, the portable CD player includes a CD driver 60 for driving an audio CD recorded with an audio signal and caption data or index data (including or not including the caption data) synchronized with the audio signal, and reading out and outputting the data, a microcomputer 50 internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit 40, and a program for processing the audio signal and the caption data or index data from data outputted from the CD driver 60, and controlling the read-out data, and a  
25 memory 10 for storing the caption data or index data controlled by the microcomputer 50. The CD player also includes a decoder 70 for demodulating the audio signal sent from the microcomputer 50, and outputting the demodulated audio signal through a speaker 80, and an LCD  
30



driver 20 for outputting the caption data or particular information (information about the title, singer, composer, and position information of a sing corresponding to the audio signal, and caption data) included in the index data through an LCD 30 in sync with the audio signal under the control of the microcomputer 50.

The audio CD, which is used in accordance with the embodiment of the present invention, may be a general audio CD or a multi-session type data CD adapted to store both audio signals and data. In particular, the data stored in the audio CD may be caption data or index data synchronized with the audio signals stored in the audio CD. The index data may include particular information. As shown in Fig. 5a, the caption data may have a conventional format including a header, time data, and caption text data. On the other hand, the index data has a particular format which will be described hereinafter with reference to Fig. 5b.

The audio CD, which is read by the CD driver 60, is recorded with the pronunciations of sentences or words for learning of a language on a particular audio track thereof. The caption data or index data (including or not including the caption data) is recorded on a data recording area where the audio CD is of a multi-recording (multi-session) audio CD type, while being recorded on an outermost track where the audio CD is of a general audio CD type. Where the caption data or index data (including or not including the caption data) is recorded on the outermost track of the general audio CD, its recording format is not the recording format adapted for general audio data, but the recording format adapted for general digital data.

The index data has particular information including position data for synchronizing caption data with an associated audio signal. This index data is recorded in the form of a small-size file having a size of several ten kilobytes to several hundred kilobytes. The index data may also include still image data. In this case, it is possible to display the still image in sync with the audio signal, along with the caption data. Using the index data synchronized with the audio signal, it is possible to easily achieve a repeated playback for a particular block of the audio signal, and an easy search for a particular word or lyrics.

When an audio CD recorded with audio signals and caption data or

index data (including or not including the caption data) is loaded in the CD player, the CD driver 60 detects the loaded state of the audio CD, and informs the microcomputer 50 of the CD loaded state in order to drive the audio CD. After detecting the CD loaded state, the microcomputer 50 controls the CD driver 60 to extract an audio signal and caption data or index data associated with the audio signal. The extracted audio signal and caption data or index data are stored in the memory 10 under the control of the microcomputer 50. The caption data directly stored in the memory 10 or the caption data included in the index data stored in the memory 10 is subsequently outputted in accordance with a command from the user so that it is displayed as a caption.

Meanwhile, the audio signal read out by the microcomputer 50 is outputted to the decoder 70 which, in turn, demodulates the audio signal so that the audio signal is outputted through the speaker 80 in the form of an audio sound audible to the user. The audio signal may be any recordable audio contents such as vocal contents of a native speaker for learning of a foreign language, for example, English, reverentially-read vocal Bible contents, reverentially-read vocal Koran contents, and accompaniment contents.

The LCD driver 20 displays, through the LCD 30, information about the audio signal, for example, caption text information corresponding to the audio signal, such as an English sentence or words. For instance, when a voice "How are you!" is outputted through the speaker 80, caption text information "How are you!" is simultaneously displayed on the LCD 30. The caption data, which is currently outputted, is a caption synchronized with the currently-outputted audio signal under the control of the microcomputer 50.

The index data includes caption data, along with particular information such as song titles, singers, composers, and position information. This index data will be described hereinafter in detail. In accordance with the present invention, there is a visual data recognition effect in that caption data is outputted from the audio CD, simultaneously with voice or audio data associated therewith, as compared to the conventional case in which the data recorded on a conventional audio CD is outputted only in the form of a voice or audio sound. On the other hand, in the case of index data not including

caption data, no caption data is displayed. In this case, information about block repeat, song title, and singer is outputted without displaying the caption data.

5 The CD player of Fig. 1 having the above described configuration is applicable to the case of using data CDs. Typical data CDs can be recorded with compressed files of a digital audio format such as MP3, WMA, and AAC files. Such a digital audio signal is recorded in the form of a file on a data CD which is also recorded with caption data or index data associated with the digital audio signal. The caption data or index data (including or not including the caption data) has the same file format as the caption data or index data described in conjunction with the audio CD. The configuration of the CD player differs according to the case of using the audio CD and the case of using the data CD. That is, the CD player should include decoders having exclusive decoding functions for respective audio signals of the audio and data CDs so as to demodulate the audio signals, respectively. In this case, the microcomputer 50 is also programmed to drive the exclusive decoders. In either case, the decoded audio signal is outputted through the speaker 80, as in the conventional case.

20 Fig. 2 illustrates another embodiment of the CD player according to the present invention. Shown in Fig. 2 is a block diagram of the CD player configured to provide caption data while playing back a conventional audio CD recorded with no caption data or index data.

25 In accordance with this embodiment, the CD player reads out and plays back audio signals from a commercially available audio CD or data CD through its CD driver 60 in a conventional manner. In this case, caption data and/or index data including particular information synchronized with the audio signals is not recorded on the data CD, but directly stored in the memory 10. The caption data and/or index data stored in the memory 10 is not read out by the CD driver 60, but inputted through a data interface 90.

30 In other words, the CD player receives caption data or index data (including or not including the caption data), synchronized with an audio signal recorded on an audio CD loaded in the CD player, from the microcomputer 50 via the data interface 90. The data interface 90 can exchange data with an external device, for example, a personal computer 92, a

cellular phone 94, or a PDA.

5 In this case, the microcomputer 50 performs a matching process for identifying whether or not the caption data or index data transmitted from the microcomputer 50 corresponds to the audio signal recorded on the audio CD or data CD. Thus, the caption display function according to the present invention has an advantage in that it is also applicable to general audio CDs or data CDs recorded with no caption data or index data (recorded only with digital audio signals).

10 When a caption display command is inputted by the user in a state in which caption data or index data including the caption data is stored in the memory 10, the microcomputer 50 detects audio signals through the CD driver 60 in a conventional manner, and outputs the detected audio signals to the speaker 80 via the decoder 70, while reading out, from the memory 10, caption data synchronized with the audio signals outputted through the speaker 80, and outputting to the LCD 30 via the LCD driver 20.

15 The data interface 90 may be implemented using devices capable of inputting and outputting data in a wireless or wired manner in order to exchange data with the personal computer 92, as described above. Such wireless or wired data exchange devices may be serial ports, parallel ports, USB ports, IEEE1394 buses, Bluetooth devices, IR ports, or wireless LAN cards. These wireless or wired data exchange devices are fabricated in the form of modules, and mounted to both the personal computer 92 and the portable CD player of the present invention. It will be appreciated that data exchange devices other than the above mentioned devices may also be used.

20 The caption data or index data including the caption data, which is transmitted via the external device, can be supplied using an Internet server via an Internet communication network.

25 In other words, as shown in Fig. 2, the personal computer 92 or cellular phone 94, which is an external device adapted to transmit caption data or index data to the microcomputer 50 through the data interface 90, is connected to the Internet in a wired or wireless manner so that it receives caption data or index data (including or not including the caption data) of a particular audio CD or data CD supplied from a server which is also connected to the Internet in a wired or wireless manner.

30

5 The personal computer 92 or cellular phone 94 sends the caption data or index data received from the server to the CD player of the present invention. Thus, the user can obtain caption data and other useful particular information (including index data) associated with an audio CD or data CD possessed by him through a communication network.

10 Referring to Fig. 10, a server 200 is shown which transmits caption data or index data requested by the personal computer 92 or cellular phone 94 in accordance with a conventional FTP (File Transmission Protocol) or the file transmission function of a Web browser. For transmission of the caption data or index data, the server 200 requests the personal computer 92 or cellular phone 94 to input the serial number of the associated audio CD or an identification number distinguishing the audio CD from other audio CDs. Only when correct information is inputted, the server 200 transmits the requested caption data or index data.

15 In order to manage caption data or index data, the server 200 includes a file transmission module, an identification module for identifying the identification number of an audio CD or data CD, a Web processing module for Internet communication, a database module for storing and managing caption data or index data, and a management module.

20 The memory 10, which is described in conjunction with Figs. 1 and 2, may be configured using a general RAM or a flash memory or nonvolatile memory. In particular, the memory 10 may have a detachable structure so that it is detachably coupled to the CD player. In this case, if it is desired to play back a particular audio CD or data CD associated with caption data or index data not stored in the memory 10, the memory 10 can be replaced with another memory stored with the caption data or index data corresponding to the particular audio CD or data CD. It will be appreciated that the CD player of Fig. 2 having the above described configuration is also applicable to the case of using data CDs.

30 The CD player according to the present invention can also be used in a Karaoke mode where the played-back audio signal is not an audio signal for learning purposes, but a music signal. This can be achieved by outputting caption data representing the lyrics corresponding to the music signal through a conventional television or monitor, simultaneously with the outputting of

the music signal through the speaker 80 in the form of a voice or audio sound.

Figs. 3 or 4 is a block diagram illustrating another embodiment of the present invention in which caption data included or not included in index data is displayed through a television 102 or a monitor 104.

5 In either case of Fig. 3 or 4, an OSD (On Screen Display) driver (device) 100 is connected to the microcomputer 50. Connected to the OSD driver (device) 100 is the television 102 or monitor 104. The OSD driver (device) 100, which is adapted to perform an OSD function, converts the text of contents corresponding to a voice or audio sound outputted through the  
10 speaker 80 so as to display the text on the television 102 or monitor 104.

For example, where a voice sound corresponding to the lyrics "yesterday, ..." is outputted through the speaker 80, the caption "yesterday, ..." is displayed on the television 102 or monitor 104. Where a voice sound corresponding to vocal Bible contents reverentially read by a minister for  
15 preaching is outputted through the speaker 80, a corresponding caption text is outputted. Also, where a particular portion of the vocal Bible contents (for example, Chapter 1, Verse 1) is designated, based on associated index data, the voice sound corresponding to the designated content portion is outputted through the speaker.

20 Where the television 102 has an OSD function, it is possible to display an OSD text on the television 102 by directly transmitting associated caption data to the television 102 without using the OSD driver (device) 100. Similarly, where the monitor 104 has an OSD function, it is possible to display an OSD text on the monitor 104 by directly transmitting associated  
25 caption data to the television 102 without using the OSD driver (device) 100. On the other hand, where neither the television 102 nor the monitor 104 has an OSD function, caption data is transferred from the OSD driver (device) 100 to the television 102 or monitor 104 in order to display an associated OSD text.

30 Fig. 4 illustrates the case in which the CD player further includes an external OSD device adapted to display an OSD text. The external OSD device, which is denoted by the reference numeral 100' in Fig. 4, includes the same configuration as the OSD configuration of Fig. 3, that is, the OSD driver 100, the television 102, and the monitor 104. The CD player of Fig. 4

further includes a data transmitter 110 adapted to transmit data to the external OSD device 100'. The data transmitter 110 performs a data conversion function in order to transmit caption data outputted from the microcomputer 50 to the external OSD device 100'. In accordance with this embodiment, it is possible to display caption data on the television 102 or monitor 104 of the external OSD device 100' which may be disposed at a place remote from the CD player.

Thus, it is possible to achieve a simple Karaoke function by outputting music from an audio CD or data CD while simultaneously outputting caption data representing the lyrics corresponding to the outputted music through the television 102 or monitor 104 in accordance with the configuration including the OSD driver (device) 100 or the configuration including the OSD device 100' and data transmitter 110.

The acquisition of caption data or index data in the embodiments of the present invention illustrated in Figs. 3 and 4 can be achieved, using any one of the two systems respectively described in conjunction with Figs. 1 and 2, and adapted to store caption data or an index file on an audio CD or data CD and to externally receive an index file via the data interface 90 and store the received index file.

In accordance with the present invention, it is also possible to output the voice of the user through the speaker 80 by additionally providing a microphone 122 and a microphone amplifier 120, as shown in Figs. 3 and 4. For example, when the user inputs his voice through the microphone 122 during the outputting of contents for learning of a language or the outputting of a song, the voice is mixed with an audio signal outputted from the decoder 70, so that it is outputted through the speaker 80 simultaneously with the audio signal. A volume adjuster (variable resistor) may be connected to the microphone amplifier 120 in order to adjust the volume of the output voice.

Fig. 5b shows a file format of index data according to the present invention.

As shown in Fig. 5b, the index data file format consists of five fields, that is, a header field, a path table field, a command field, an audio field, and a caption field. On the other hand, conventional caption data formats, an example of which is shown in Fig. 5a, consist of a header field, a time

information field, and a caption data field. It will be appreciated that such a conventional caption data file format is considerably different from the data file format of the present invention.

5 In the data file format of the present invention, its header field consists of an ID sub-field for storing an ID representing the kind of the currently read-out file, for example, index data, a version sub-field for storing a version value to manage a version updated in accordance with an addition of new functions, a character code sub-field for storing character codes used for texts in the currently read-out file, and offset sub-fields for storing offset values, that is, addresses, respectively representing the path table, command, 10 audio, and caption fields. This structure of the header field can be simply indicated by the following Table 1:

Table 1

Sub-Field	Size	Remark
ID	2	
Version	2	
		e.g.) 3: Unicode
		4: ASCII Code
		5: Korean Unified Code
		6: JIS Code (Japanese)
		7: GB Code (Chinese)
Character Code	2	
Reserved	10	
Path Table Field Offset	4	
Command Field Offset	4	
Audio Field Offset	4	
Caption Field Offset	4	
Reserved		

15 As shown in Table 1, caption data (character codes) can be stored in the form of Unicodes, ASCII codes, Korean unified codes, JIS codes, or GB codes. The microcomputer 50 recognizes such character codes, and converts the recognized character codes into caption data in an appropriate manner



meeting the character codes.

The pass table field is a field set to store respective paths of all data files included in index data. Each data file stored in the pass table field consists of a descriptor. Accordingly, the pass table field consists of a set of descriptors, as simply indicated in the following Table 2:

Table 2

Descriptor	Size	Remark
Path	4	Address of Field Representing Sub-Directory 0: Directory 1: File 2: Address in Index File
Type	1	3: List 0: No 1: Yes
Existence of Caption	1	2: Unknown (Search)
File Name Size	2	Size of Descriptor "Fine Name" This indicates directory or file name, If not the type of 2 (List).
File Name	(File Name Size)	If the type of 2 (List), it indicates an arrangement of addresses where respective descriptors of files exist (each being 4 bytes). This has a value of 0 when the number of all descriptors is odd, while having no value when the number of all descriptors is even.
Padding	1 or 0	

The command field is a field adapted to link the screen configuration of a user interface with files to be executed upon being selected. This command field consists of lists respectively corresponding to menus. Each list consists of a menu item, and several sub-items. Each item consists of diverse descriptors, as described in Table 3. Each item has a size of 64 bytes.

16  
Table 3

Descriptor	Size	Remark
Path Offset	4	Address in the path table of a file to be actually executed when the user selects an execution (playback) of the file. If 0, no execution is made.
Sec	2	Time point of a block of the file to be executed when the user selects an execution (playback) of the file.
Ratio	2	The actual time of the descriptor "Sec" is calculated together with a ratio. If ratio > 0, actual time = sec/ratio. If ratio < 0, actual time = sec*ratio.
Next Offset	4	If a first item of the list (Item 0), addresses of higher-order menus in the menu item. If 0, there is no higher-order menu. Otherwise, addresses of items to be displayed when a desired sub-item is selected from the menu item. If 0, there is no sub-item.
Number of Menus	2	If Item 0, the number of items included in the menu. Otherwise, the number of tracks to be executed when an index file for an audio CD is selected to be executed.
Size of Character String	2	Size of Character String of Each Item To Be Displayed on Screen
Character String	48	Character String of Each Item To Be Displayed on Screen

5 The audio field has the same structure as the command field, except that it can be directly obtained from the header field. The menus of the audio field should be configured in the track order. This field is adapted to easily search for the link of each track to caption data in the case of an audio CD.

The caption field consists of a caption file recorded on the CD. This caption file may be divided into sub-files. However, it is preferable for this field to be configured to store captions needed in the entire portion of the CD in a single index file, so as to manage the captions using the single index file. Each caption in this field has the same structure as that of an associated caption file. Fig. 6 shows the entire structure of the index file. A detailed description of this structure will be eliminated because it duplicates the above description.

The operation of the CD player having the above described configuration, in particular, the CD player illustrated in Fig. 1, will be described with reference to a flow chart of Fig. 7.

When the user loads an audio CD in the CD player at a start step in order to play back the audio CD, it is determined whether the loaded audio CD is a general audio CD or an audio CD recorded with caption data or index data according to the present invention. This determination is carried out by searching for ID data recorded on a particular area of the audio CD. Where the loaded audio CD is a general audio CD, the microcomputer plays back an audio signal recorded on an audio track of the audio CD. When the user repeatedly presses an FF button included in the key input unit of the CD player in this state, the CD player jumps audio tracks corresponding to the number of button pressing times, and plays back an audio signal recorded on a target audio track.

Such a playback procedure is also applied to a data CD recorded with MP3 files, similarly to audio signals recorded on audio tracks. In this case, the playback procedure for MP3 files is not carried out in a track unit, but carried out in an MP3 file unit.

In a multi-session type audio CD, caption data or index data is recorded on a data field. In an audio CD, such caption data or index data is recorded on an extra track. Since there are typically 99 tracks in an audio CD, it is desirable to record caption data or index data on the outermost audio track of the audio CD. Subsequently, the microcomputer searches for an ID and version included in the index data in order to identify whether or not the index data can be processed. When it is determined that only caption data other than index data is recorded on the audio CD, the caption data is

automatically displayed in sync with the outputting of an associated audio signal. Also, in the case of a data CD, when it is determined that only caption data is recorded on the data CD, the caption data is automatically displayed.

5           After identifying the recorded position of the caption data or index data (including or not including the caption data), the microcomputer reads out the caption data or index data, and stores the read-out caption data or index data. After completing the storage of the caption data or index data, the CD player waits for a key input command from the user. The user may  
10       input a particular command through the key input unit included in the CD player.

          The input command may include diverse commands associated with a sequential play mode, a (block) repeat play mode, an once forward play mode, a reverse play mode, a menu play mode for performing selected diverse  
15       functions associated with a playback operation, and a play-list play mode. In the sequential play mode, audio signals are played back in the position order of audio tracks or files on an audio CD loaded in the CD player. When a sequential play command is inputted, the microcomputer outputs caption data in sync with the outputting of an associated audio signal. For example, in  
20       the case of an audio signal recorded with audio signals in the order of A, B, C, D, ..., when the audio signals are played back in the order of A, B, C, D, ..., the caption data corresponding to the audio signals is also outputted in the same order as the audio signal outputting order of A, B, C, D, .... Where the  
25       played-back audio signal is a song, a text corresponding to the lyrics of the song outputted in the form of a voice sound is displayed on the LCD in sync with the outputting of the lyric voice sound of the song. The identification of the recorded position of the caption data is executed in such a manner that the microcomputer acquires data stored in the index file, that is, the address of a selected data file, for example, a selected song, stored in a path table  
30       included in a command item associated with the selected data file.

          In a repeat play mode, a predetermined block of audio signals is repeatedly played back. For example, when a repeat play command is inputted during the playback of the first track on an audio CD, this first track is again played back. In this case, caption data is repeatedly displayed in

sync with the audio signal of the first track.

In a menu play mode, that is, when the user selects a particular menu from menus displayed on the LCD, a desired audio signal is extracted in accordance with the execution of the selected menu. In this case, caption data corresponding to the extracted audio signal is also extracted so that it is played back simultaneously with the audio signal. Such caption data is in a state of being stored in the memory of the CD player. In accordance with the selected menu, it is possible to select and play back a desired song on the basis of genre, singer, year, or song title. The menu type user interface is provided on the basis of the command offsets of the command field. In accordance with such selection references, the microcomputer extracts a song corresponding to the selection references, and displays the extracted result on the LCD. Examples of menus selected in accordance with desired selection references are shown in Figs. 8 and 9, respectively.

In the case of Fig. 8, audio signals (songs in this case) to be played back are selected in terms of singers. When a singer menu is selected, a list of signers recorded on the audio CD is outputted. When a particular singer is selected from the outputted singer list, a list of songs sung by the selected singer is outputted. Then, the user selects a particular song from the outputted song list, and completes the menu. After completion of the menu, the CD player outputs an audio signal corresponding to the selected song. Simultaneously, caption data corresponding to the selected song is extracted from the index file stored in the memory. Where only caption data is recorded on the audio CD, the caption corresponding to the selected song is automatically outputted.

After being extracted, the caption data is outputted in sync with the outputting of the associated audio signal. Thus, a voice sound corresponding to the lyrics of the song is outputted through the speaker of the CD player. Simultaneously, a text (caption) corresponding to the lyrics of the song is outputted through the LCD.

Although the extraction of caption data has been described as being performed in a song unit with reference to the start of each song, caption data sub-divided in a stanza or bar unit may be outputted. For example, caption data corresponding to a first or second stanza or first or second bar of the

lyrics of a song may be outputted. This can be achieved using time point data of respective stanzas and bars of the lyrics. The time point data is previously stored in the index data. When the user selects a desired stanza and bar of the lyrics, for example, the first stanza, the second bar of the lyrics, the microcomputer reads out the time point data corresponding to the selected stanza and bar, and outputs an audio signal corresponding to the read-out time point. At the same time, the microcomputer reads out caption data corresponding to the read-out time point, and outputs the read-out caption data through the LCD. The selection of a desired lyric stanza and bar may be carried out on a menu screen in a pull-down menu fashion, as shown in Fig. 8. Such a selection method may be used for an audio CD stored with 100 songs or more in the form of MP3 files.

On the other hand, for an audio-only CD, a more simplified menu may be used, as shown in Fig. 9. Most general audio CDs are recorded with songs of a single singer. In this case, although only a list of song titles is outputted without outputting any other menu, for example, a singer menu, as shown in Fig. 9, the user can select a desired song from the song title list. Once a desired song is selected, a stanza/bar menu is displayed on the menu screen so as to allow the user to select a desired stanza and bar. When each track is played back, information associated with the track (for example, information about the associated caption, song title, singer, etc.) is acquired, based on an audio offset stored in the index file, and then displayed on the LCD.

Although the audio playback method of the present invention has been described in conjunction with songs, its procedures of outputting and searching caption data can be applied to various fields such as language lectures, public speeches, and sermons, the contents of which are produced in the form of audio signals.

A play list may be used in place of the selection menus. In this case, the play list can be produced using respective addresses of songs stored in associated path tables. Based on the play list, a selected song and caption data corresponding to the selected song are outputted.

After completion of the song selected using the above described menus, the CD player determines whether or not an end command is inputted.

If there is no end command input, the CD player is maintained in a standby state.

5 In the embodiment of Fig. 2, the CD player operates in a manner similar to the above described manner, except that caption data or index data is not acquired from the CD, but acquired via the data interface 90. Accordingly, no further description will be given of this embodiment.

#### Industrial Applicability

10 As apparent from the above description, the present invention can provide a multi-session type CD capable of recording diverse information, as compared to conventional single-session type CDs, while being 100% compatible with conventional CD players. In accordance with the present invention, it is possible to make a general audio CD provide caption data for learning purposes, caption data of song lyrics, singer names, song titles, etc. by linking the audio CD to particular information through an index file. In  
15 accordance with the present invention, desired data can be easily searched for in terms of singer, genre, year, and song title, using selection menus. It is possible to avoid generation of noise involved with a conventional recording system adapted to record an audio signal and caption data in a mixed manner on the same track when the audio signal and caption data are played back.  
20 The audio CD and data CD of the present invention can be used, using a conventional driver.

It is also possible to easily achieve a block repeat function which is an essential function for learning of languages. Also, a powerful voice mixing function is provided which can greatly improve the speaking function very  
25 important to learning of languages and the song lyrics learning comprehension. Even a user who cannot operate a computer can easily operate the CD player of the present invention, as compared to conventional flash memory type MP3 players. Diverse contents can be utilized, using widely-distributed conventional audio CDs as they are. A smart audiovisual  
30 classroom can be easily constructed, using an existing television or monitor. Since caption data can be easily downloaded through an external device such as a cellular phone, it is possible to input data, to output the input data, and to use the appliance, irrespective of time and place.

## Claims

1. A portable CD player comprising:

5 a CD driver for reading out and outputting an audio signal and caption data from an audio CD separately recorded with the audio signal and the caption data on different tracks thereof or different sessions thereof, respectively, the caption data being synchronized with the audio signal;

10 a microcomputer internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit, and a program for processing the audio signal and the caption data respectively outputted from the CD driver;;

a memory for storing the caption data sent from the microcomputer;

a decoder for demodulating the audio signal sent from the microcomputer, and outputting the demodulated audio signal through a speaker; and

15 an LCD driver for outputting the audio signal while simultaneously outputting the caption data synchronized with the audio signal, through an LCD, under a control of the microcomputer.

2. A portable CD player comprising:

20 a CD driver for reading out and outputting a digital audio signal and caption data from a data CD separately recorded with the digital audio signal and the caption data on different portions thereof, respectively, the caption data being synchronized with the digital audio signal;

25 a microcomputer internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit, and a program for processing the digital audio signal and the caption data respectively outputted from the CD driver;;

a memory for storing the caption data sent from the microcomputer;

30 a decoder for demodulating the digital audio signal sent from the microcomputer, and outputting the demodulated digital audio signal through a speaker; and

an LCD driver for outputting the digital audio signal while simultaneously outputting the caption data synchronized with the digital audio



signal, through an LCD, under a control of the microcomputer.

3. A portable CD player comprising:

a CD driver for reading out and outputting an audio signal from an audio CD recorded with the audio signal;

5 a data interface for receiving, from an external device, caption data synchronized with the audio signal recorded on the audio CD;

a microcomputer internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit, a program for processing the audio signal outputted from the CD driver, and a program for receiving the caption data from the data interface, and processing the received caption data;

10 a memory for receiving the caption data from the microcomputer, and storing the received caption data;

a decoder for demodulating the audio signal sent from the microcomputer, and outputting the demodulated audio signal through a speaker; and

15 an LCD driver for outputting the audio signal while simultaneously outputting the caption data synchronized with the audio signal, through an LCD, under a control of the microcomputer.

20 4. A portable CD player comprising:

a CD driver for reading out and outputting a digital audio signal from a data CD recorded with the digital audio signal;

a data interface for receiving, from an external device, caption data synchronized with the digital audio signal recorded on the data CD;

25 a microcomputer internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit, a program for processing the digital audio signal outputted from the CD driver, and a program for receiving the caption data from the data interface, and processing the received caption data;

30 a memory for receiving the caption data from the microcomputer, and storing the received caption data;

a decoder for demodulating the digital audio signal sent from the

microcomputer, and outputting the demodulated digital audio signal through a speaker; and

an LCD driver for outputting the digital audio signal while simultaneously outputting the caption data synchronized with the digital audio signal, through an LCD, under a control of the microcomputer.

5. A portable CD player comprising:

a CD driver for reading out and outputting an audio signal and index data from an audio CD separately recorded with the audio signal and the index data on different tracks thereof or different sessions thereof, respectively, the caption data being synchronized with the audio signal while including or not including caption data;

a microcomputer internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit, and a program for processing the audio signal and the index data respectively outputted from the CD driver;

a memory for storing the index data synchronized with the audio signal and sent from the microcomputer;

a decoder for demodulating the audio signal sent from the microcomputer, and outputting the demodulated audio signal through a speaker; and

an LCD driver for outputting the audio signal while simultaneously outputting particular information included in the index data synchronized with the audio signal, through an LCD, under a control of the microcomputer.

6. A portable CD player comprising:

a CD driver for reading out and outputting a digital audio signal and index data from a data CD recorded with the digital audio signal and the index data synchronized with the digital audio signal, the index data including or not including caption data;

a microcomputer internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit, and a program for processing the digital audio signal and the index data respectively outputted from the CD driver;

25

a memory for storing the index data synchronized with the digital audio signal and sent from the microcomputer;

a decoder for demodulating the digital audio signal sent from the microcomputer, and outputting the demodulated digital audio signal through a speaker; and

an LCD driver for outputting the digital audio signal while simultaneously outputting particular information included in the index data synchronized with the digital audio signal, through an LCD, under a control of the microcomputer.

10 7. A portable CD player comprising:

a CD driver for reading out and outputting an audio signal from an audio CD recorded with the audio signal;

a data interface for receiving, from an external device, index data synchronized with the audio signal recorded on the audio CD, the index data including or not including caption data;

a microcomputer internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit, a program for processing the audio signal outputted from the CD driver, and a program for receiving the index data from the data interface, and processing the received index data;

a memory for receiving the index data from the microcomputer, and storing the received index data;

a decoder for demodulating the audio signal sent from the microcomputer, and outputting the demodulated audio signal through a speaker; and

an LCD driver for outputting the audio signal while simultaneously outputting the index data synchronized with the audio signal, through an LCD, under a control of the microcomputer.

8. A portable CD player comprising:

a CD driver for reading out and outputting a digital audio signal from a data CD recorded with the digital audio signal;

a data interface for receiving, from an external device, index data

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synchronized with the digital audio signal recorded on the data CD, the index data including or not including caption data;

5 a microcomputer internally provided with a program for executing a particular function in accordance with a command inputted from a key input unit, a program for processing the digital audio signal outputted from the CD driver, and a program for receiving the index data from the data interface, and processing the received index data;

a memory for receiving the index data from the microcomputer, and storing the received caption data;

10 a decoder for demodulating the digital audio signal sent from the microcomputer, and outputting the demodulated digital audio signal through a speaker; and

15 an LCD driver for outputting the digital audio signal while simultaneously outputting particular information included in the index data synchronized with the digital audio signal, through an LCD, under a control of the microcomputer.

9. The portable CD player according to any one of claims 1 to 8, wherein the memory has a detachable structure so that it is detachably coupled to the CD player.

20 10. The portable CD player according to any one of claims 3, 4, 7 and 8, wherein the data interface includes a device capable of inputting and outputting data in a wireless or wired manner, the device being selected from the group consisting of a serial port, a parallel port, a USB port, an IEEE1394 bus, a Bluetooth device, an IR port, and a wireless LAN card.

25 11. The portable CD player according to any one of claims 3, 4, 7 and 8, wherein the external device connected to the data interface is a personal computer, a cellular phone, a PAD, or an IMT2000 terminal.

30 12. The portable CD player according to claim 11, wherein the external device includes communication means for downloading caption data or index data from a server via an Internet network, and storing the

downloaded caption data and index data in a memory included in the external device.

13. The portable CD player according to claim 12, wherein the caption data or index data from the server are transmitted to the external device in accordance with an FTP (File Transmission Protocol) or a file transmission function of a Web browser.

14. The portable CD player according to any one of claims 1 to 8, further comprising:

an OSD driver for outputting caption data or particular information included in index data, outputted through the LCD, in the form of an OSD text through a television or a monitor.

15. The portable CD player according to any one of claims 1 to 8, further comprising:

an external OSD device disposed at a place remote from the CD player, and adapted to perform a remote OSD function, the external OSD device including an OSD driver for outputting caption data or particular information included in index data, outputted through the LCD, in the form of an OSD text through a television or a monitor connected to the external OSD device at the remote place; and

a data transmitter adapted to transmit data needed for a caption outputting function to the external OSD device so that the external OSD device outputs an OSD text.

16. The portable CD player according to any one of claims 1 to 8, further comprising:

a microphone for inputting a voice signal of a user; and  
a microphone amplifier for amplifying the voice signal inputted thereto through the microphone, and outputting the amplified voice signal through the speaker.

17. The portable CD player according to claim 16, wherein the

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microphone amplifier includes a variable resistor for adjusting a level of the voice signal inputted through the microphone.

18. The portable CD player according to any one of claims 5 to 8, wherein the index data includes a header field containing information about an index file, a path table field containing respective paths of all data files included in the index data, and a command field containing commands for linking a screen configuration of a user interface with files to be executed upon being selected, respectively.

19. The portable CD player according to claim 18, wherein the index data further includes an audio field adapted to easily link each track of the audio CD with an associated portion of the caption data, the audio field containing commands for linking a screen configuration of a user interface with files to be executed upon being selected, respectively, and a caption field containing the caption data.

20. The portable CD player according to any one of claims 2, 4, 6, and 8, wherein the digital audio signal has the form of an MP3 format file, a WMA format file, or an AAC format file.

21. The portable CD player according to any one of claim 1 to 4, wherein the caption data is recorded on an outermost track of the audio CD.

22. A caption-displaying audio CD recorded with an audio signal on a track thereof, wherein caption data synchronized with the audio signal is recorded on a portion of the audio CD different from that of the audio CD recorded with the audio signal so that a caption corresponding to the caption data is outputted through the LCD when the audio signal is played back.

23. A multi-recording CD recorded with an audio signal on a track thereof, wherein caption data synchronized with the audio signal is recorded on a portion of the CD different from that of the CD recorded with the audio signal so that a caption corresponding to the caption data is outputted through

the LCD when the audio signal is played back.

24. A caption-displaying data CD recorded with a digital audio signal, wherein caption data synchronized with the digital audio signal is recorded on a portion of the data CD different from that of the data CD recorded with the digital audio signal so that a caption corresponding to the caption data is outputted through the LCD when the digital audio signal is played back.

25. A caption-displaying audio CD recorded with an audio signal on a track thereof, wherein index data synchronized with the audio signal is recorded on a portion of the audio CD different from that of the audio CD recorded with the audio signal, the index data including or not including caption data, so that particular information is outputted through the LCD when the audio signal is played back.

26. A multi-recording CD recorded with an audio signal on a track thereof, wherein index data synchronized with the audio signal is recorded on a portion of the CD different from that of the CD recorded with the audio signal, the index data including or not including caption data, so that particular information is outputted through the LCD when the audio signal is played back.

27. A caption-displaying data CD recorded with a digital audio signal, wherein index data synchronized with the digital audio signal is recorded on a portion of the data CD different from that of the data CD recorded with the digital audio signal, the index data including or not including caption data, so that particular information is outputted through the LCD when the digital audio signal is played back.

28. The caption-displaying audio CD according to claim 22, wherein the caption data is recorded on an outermost track of the audio CD.

29. The multi-recording CD according to claim 23, wherein the caption data is recorded on a second data session of the CD.

30. The caption-displaying audio CD according to claim 25, wherein the index data including or not including the caption data is recorded on an outermost track of the audio CD.

5 31. The multi-recording CD according to claim 26, wherein the index data including or not including the caption data is recorded on a second data session of the CD.

10 32. The caption-displaying audio CD according to any one of claims 25, 26, 30, and 31, wherein the index data includes a header field containing information about an index file, a path table field containing respective paths of all data files included in the index data, and a command field containing commands for linking a screen configuration of a user interface with files to be executed upon being selected, respectively.

15 33. The caption-displaying audio CD according to claim 32, wherein the index data further includes an audio field adapted to easily link each track of the audio CD with an associated portion of the caption data, the audio field containing commands for linking a screen configuration of a user interface with files to be executed upon being selected, respectively, and a caption field containing the caption data.

20 34. The caption-displaying data CD according to claim 27, wherein the index data includes a header field containing information about an index file, a path table field containing respective paths of all data files included in the index data, and a command field containing commands for linking a screen configuration of a user interface with files to be executed upon being selected, respectively.

25 35. The caption-displaying data CD according to claim 34, wherein the index data further includes an audio field adapted to easily link each track of the audio CD with an associated portion of the caption data, the audio field containing commands for linking a screen configuration of a user interface



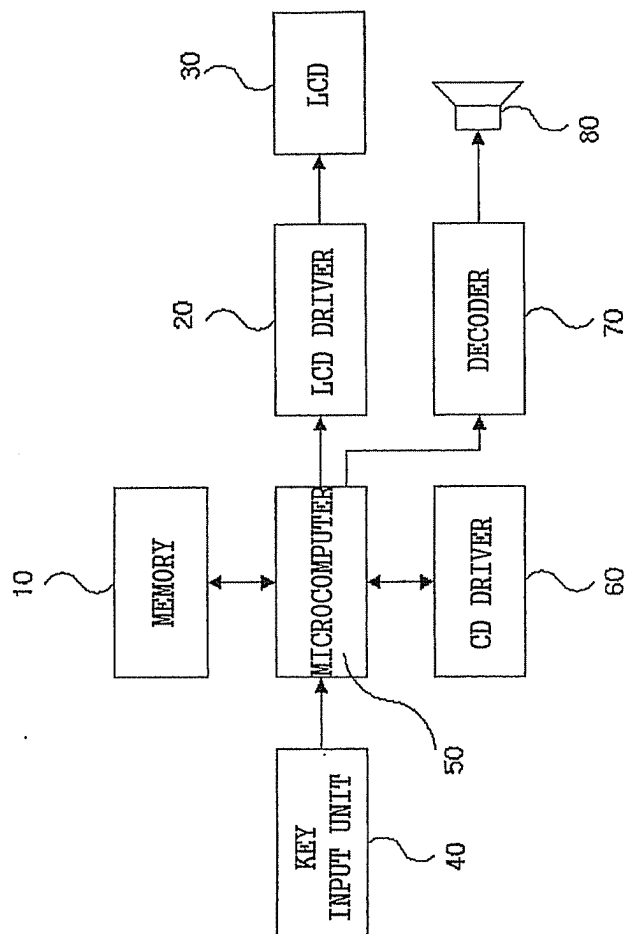
with files to be executed upon being selected, respectively, and a caption field containing the caption data.

36. A learning system comprising:

- 5 a server including a file transmission module, an identification module for identifying an identification number of an audio CD or a data CD, a Web processing module for Internet communication, a database module for storing and managing caption data or index data, and a management module;
- 10 an external device for transmitting and receiving data through a wired or wireless Internet network, the external device including a data interface; and
- a portable CD player for receiving caption data or index data transmitted from the external device, and storing the received caption data or index data.

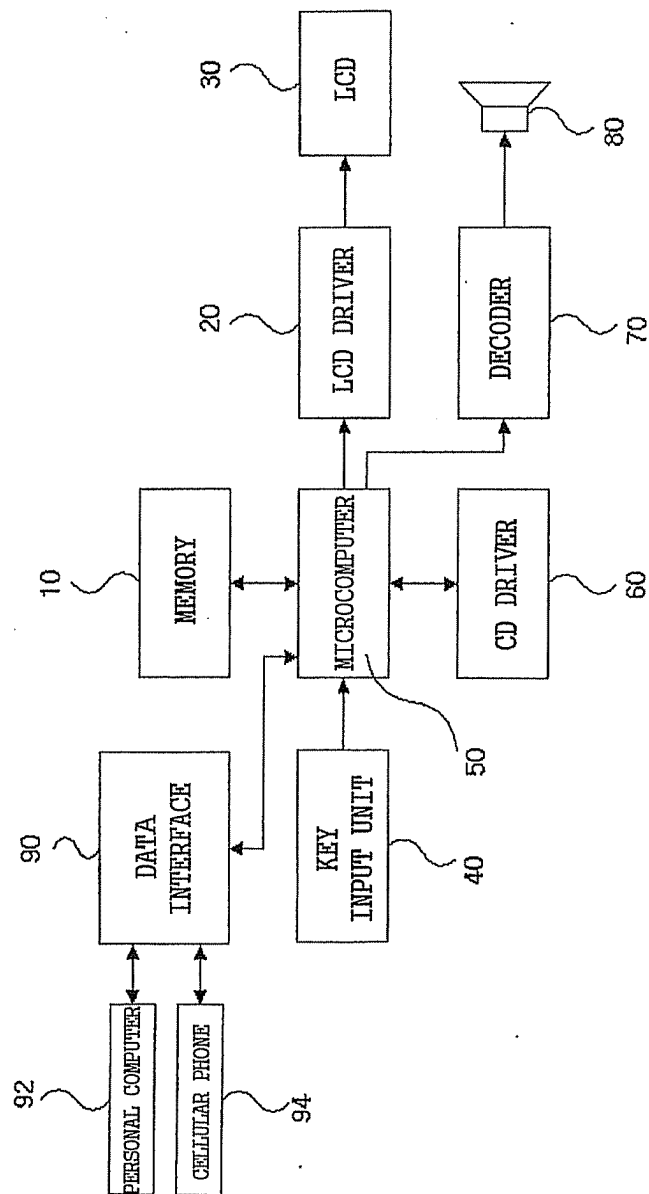
1/11

Fig. 1



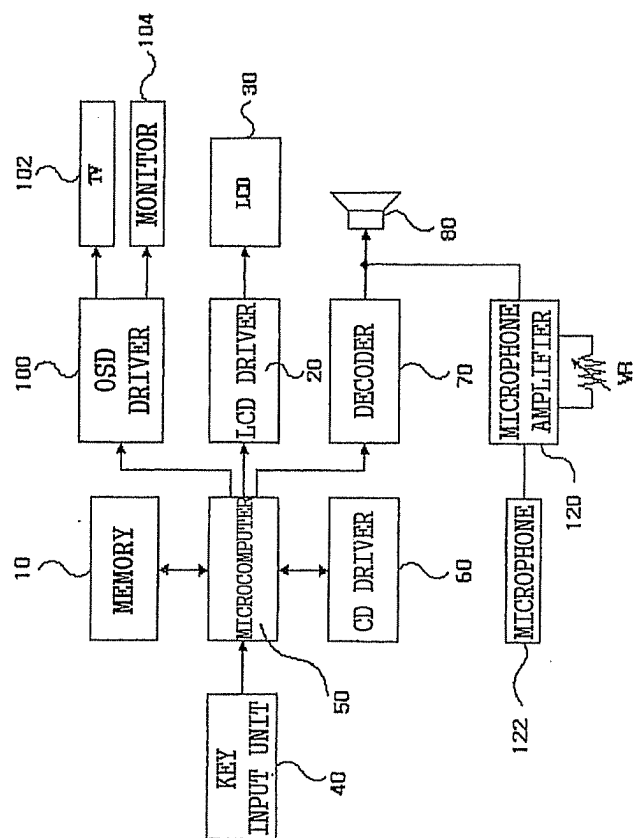
2/11

Fig. 2



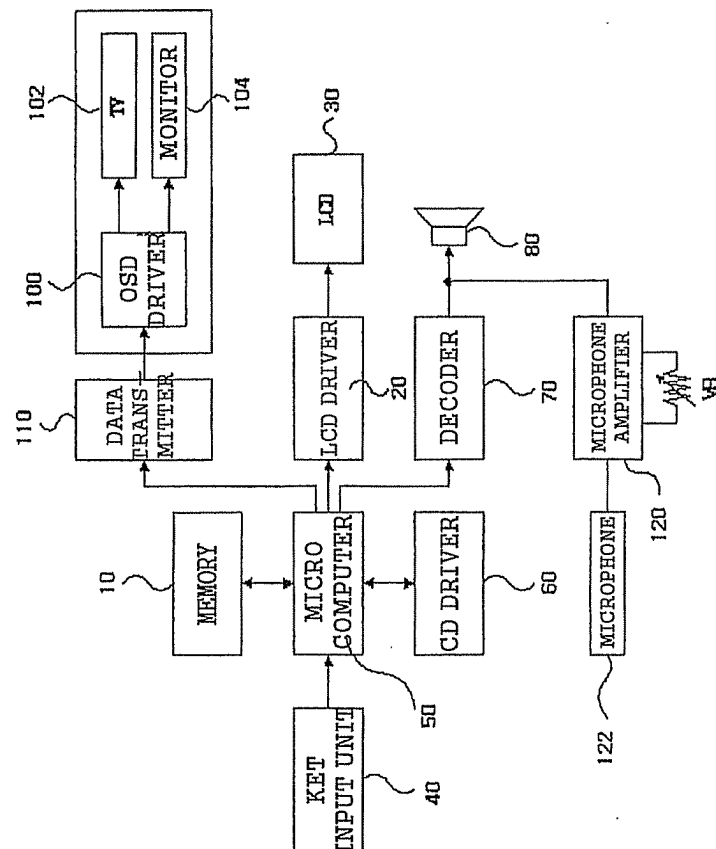
3/11

Fig. 3



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Fig. 4



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Fig. 5a

Caption Data Format

Header	Time In-formation	Caption Data	Time In-formation	Caption Data
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Fig. 5b

## Data Format

Header Field	Path Table Field	Command Filed	Audio Field	Caption Field
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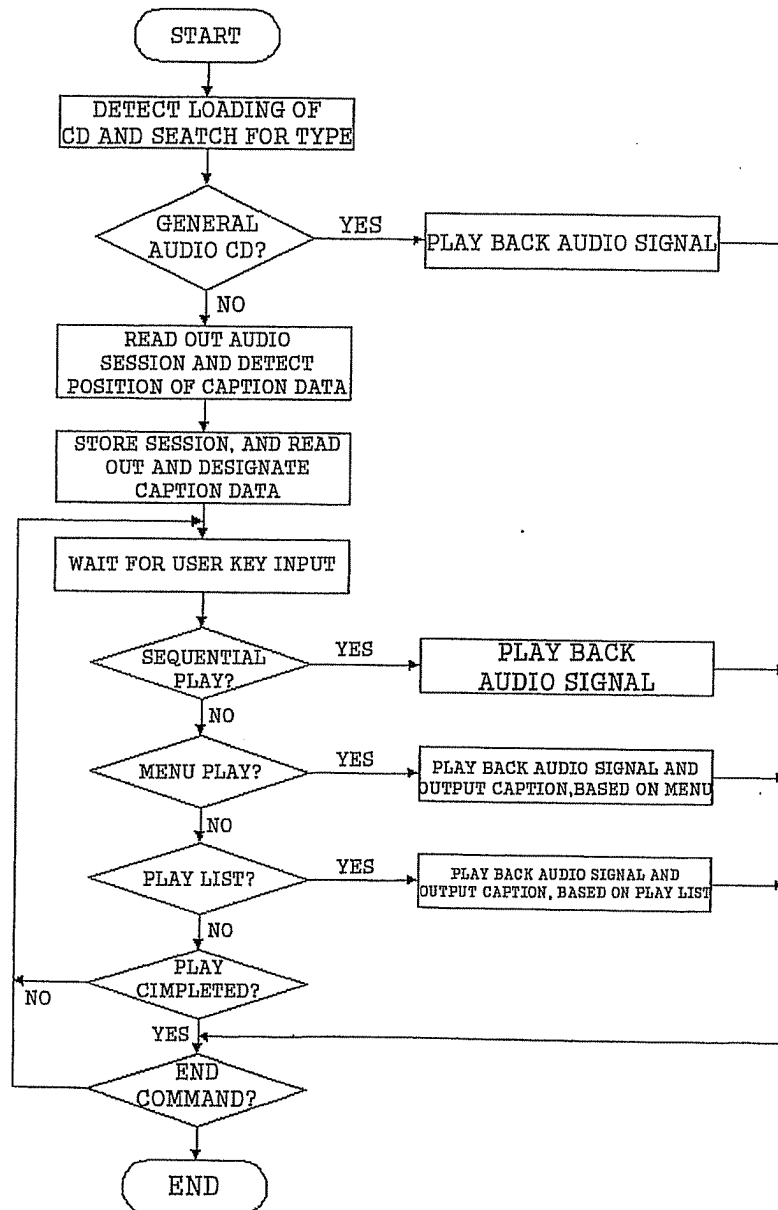
Fig. 6

ID	Version	character code					
path table offset		command offset		audio offset		caption offset	
sub-directory offset	type	cap	size of file name	file name (or list)			
path offset	sec		ratio	next offset		number of menus (or track number)	size of character string
character string							
Path offset	sec		ratio	next offset		number of menus (or track number)	size of character string
character string							
caption (this field has the same structure as each caption file)							



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Fig. 7



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Fig. 8

Popular Song		
1. Singer	Singer	
2. Genre	1. Elvis Presley	Elvis Presley
3. song Title	2. Beatles	1. Heartbreak Hotel
	3. Suede	2. Hound Dog
		3. Love Me Tender

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Fig. 9

Abba
1. SOS
2. Chiquitita
3. Fernando

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Fig. 10

